

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Friedrich BOECKING et al.
Based on : PCT/DE 03/03366
For : PIEZOELECTRIC ACTUATOR
Docket No. : R.304047
Customer No. : 02119

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Date: June 15, 2005

**INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97(b),
AND EXPLANATION OF THE RELEVANCE OF THE CITED PRIOR ART**

Sir:

The undersigned hereby requests that the prior art cited on the attached prior art statement be placed of record in the application file and be considered by the examiner.

This citation of prior art is made under 37 CFR 1.97(b), since it is being filed within three months of the filing date and before the mailing of a first Office action.

The relevance of the prior art cited on the attached form PTO/SB/08a is as follows:

Appl. No. Unknown
Based on PCT/DE 03/03366
Prior to first Office Action

US 5,252,883

This patent teaches a laminated type piezoelectric actuator having a laminated body formed by alternately laminating piezoelectric ceramic layers and internal electrode layers, each of which are approximately the same shape. The four corners or edges of each layer of the ceramic layers and the internal electrode layers, which edges extend in parallel with the lamination direction of the laminated body, are machined to form a convex, arcuate shape or an angled, planar shape. This enables the end parts of each layer, which have a high distribution density of microcracks, to be removed, so that interlayer short-circuiting between the internal electrode films caused by the microcracks is prevented. Accordingly, the operation life and the reliability of the actuator of this invention is extended and improved, respectively, even when it is driven by a driving voltage which is exactly or close to that of a dc voltage in a highly humid environment. By using a Pb (Ni_{1/3}Nb_{2/3}) O₃-PbTiO₃-PbZrO₃ system perovskite structure compound oxide as the piezoelectric ceramic piece, and removing each of the four edges in the cross section to exhibit a convex, arcuate shape with a radius of curvature equal to or greater than 1.0 mm, or an angled, planar shape having a chamfering length equal to or greater than 0.8 mm, it is possible to increase the life of the actuator to about 10 times that of the actuator in the prior art.

US 2002/0153431 A1

This published patent application teaches a piezoelectric element and an injector using the same piezoelectric element. The element and injector are constructed so as not to be shorted in a high humidity environment. They are small in size, low in cost, and high in heat

10/539041

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radiation capability. The piezoelectric element comprises a ceramic laminate (10) including a plurality of ceramic layers of a piezoelectric ceramic (11) and a plurality of internal electrode layers (21, 22), stacked alternately. At least an organic insulating layer (41) of an organic material is formed on at least a part of the surface of the ceramic laminate (10), and at least an inorganic insulating layer (42) of an inorganic material is formed on the organic insulating layer (41).

US 2002/0152857 A1

This published patent application teaches a high reliability ceramic laminate which suppresses de-lamination and cracks. Wide ceramic sheets are temporarily laminated by heat and pressure to form a pre-laminate which is cut to form a unit body. Unit bodies are laminated to obtain a ceramic laminate. De-waxing removes not less than 90% of a binder resin before the ceramic laminate is sintered.

WO 03/010835 A2

This patent publication teaches a multi-layer PZT which comprises a plurality of stacked ceramic layers. The stack of ceramic layers includes a top ceramic layer on which negative and positive contacts for electrically coupling the PZT to external circuitry are formed. The stack of ceramic layers also includes at least one negatively poled ceramic layer having a negative conductive pattern formed thereon and at least one positively poled ceramic layer having a positive conductive pattern formed thereon. The PZT also includes a negative pattern interconnect for electrically connecting the negative contact and the negative conductive pattern and a positive pattern interconnect for electrically connecting the positive

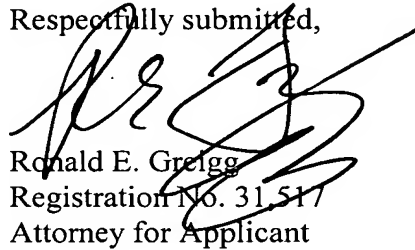
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Appl. No. Unknown
Based on PCT/DE 03/03366
Prior to first Office Action

contact and the positive conductive pattern. The multi-layer PZT can be fabricated using a ceramic co-firing process.

Examination of this application is respectfully requested.

Respectfully submitted,



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Substitute for form 1449A/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>		Complete if Known Application Number 10/539041 Filing Date _____ First Named Inventor Friedrich Boecking et al. Art Unit _____ Examiner Name _____ Attorney Docket Number R.304047	
Sheet	1	of	1

U.S. PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Document Number		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number	Kind Code ² (if known)			
		US-	2002/0153431 A1	10-24-2002	Kazuhide Sato et al.	
		US-	2002/0152857 A1	10-24-2002	Kazuhide Sato et al.	
		US-	5,252,883 A	10-12-1993	Masahiro Kondo	
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FOREIGN PATENT DOCUMENTS								
Examiner Initials*	Cite No. ¹	Foreign Patent Document			Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶
		Office ³	Number ⁴	Kind ⁵ (if known)				
		WO	03/010835	A2	02-06-2003	Christina M. Schober et al.		✓

Examiner Signature		Date Considered	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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